UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/531,047	04/12/2005	Shouichirou Sawa	MAM-061	2630

20374 7590 12/22/2010

KUBOVCIK & KUBOVCIK
SUITE 1105
1215 SOUTH CLARK STREET
ARLINGTON, VA 22202

EXAMINER	
HAN, KWANG S	
ART UNIT	**PAPER NUMBER**
1727	

MAIL DATE	DELIVERY MODE
12/22/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/531,047	SAWA ET AL.	
	Examiner	Art Unit	
	Kwang Han	1727	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 September 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

LITHIUM SECONDARY BATTERY INCLUDING A NEGATIVE ELECTRODE WHICH IS A SINTERED LAYER OF SILICON PARTICLES AND/OR SILICON ALLOY PARTICLES AND A NONAQUEOUS ELECTROLYTE CONTAINING CARBON DIOXIDE DISSOLVED THEREIN AND METHOD FOR PRODUCING THE SAME

Examiner: K. Han SN: 10/531,047 Art Unit: 1727 December 20, 2010

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 30, 2010 has been entered. Claims 1, 3, and 26 were amended.

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

3. The claim rejection under 35 U.S.C. 103(a) as unpatentable over Fukui et al. in view of Hiroshi et al. on claims 1-29 is withdrawn, because claims 1 and 3 has been amended.

Claim Rejections - 35 USC § 102/103

4. Claims 1-13, 14-18, 20, 24-29 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ishizuka et al. (JP 10-040958, machine translation, formerly referred to as "Hiroshi").

Regarding claims 1 and 3, Ishizuka is directed towards a rechargeable lithium battery [Abstract] comprised of a negative electrode material including silicon [0017], a binder on the surface of a conductive metal foil current collector [0035, 0039], a positive electrode, and a nonaqueous electrolyte with carbon dioxide dissolved and added in the electrolyte [0010-0012]. The active material particles of Ishizuka would inherently undergo a porosity increase that advances from particles surfaces during charge and discharge since the active materials are the same as the Applicant's disclosed materials of an active material containing silicon and silicon alloys used in a rechargeable lithium battery [Paragraph 0003 of Applicant's disclosure]. Furthermore Ishizuka discloses the use of electrolyte solvents such as carbonates [0013] and the active material comprised of materials that alloy with lithium but does not explicitly teach the electrolyte forming a film having a lithium-ion conducting capability on a surface of a negative electrode. While the prior art does not explicitly teach the dissolved carbon dioxide forming a film having a lithium-ion conducting capability, these properties are considered inherent in the prior art barring any differences shown by objective evidence between (the object) the electrolyte containing carbon dioxide with the active material disclosed in the prior art and the applicant. As (the object) electrolyte and negative electrode material taught by the prior art and the applicant are identical within the scope of claims 1 and 3,

Ishizuka inherently teaches that the electrolyte containing carbon dioxide forms a film having a lithium-ion conducting capability on the surface of the negative electrode. The evidence of Ishizuka disclosing both the same active materials with the same electrolyte with dissolved carbon dioxide providing increased charge-discharge cycles without spoiling the high capacity of the battery characteristics [Abstract, 0009-0012] makes clear the missing ion conducting film is present and would be recognized by one of ordinary skill in the art. In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (MPEP 2112).

Regarding claim 2, Ishizuka discloses sintering performed in an inert gas atmosphere [0030].

Regarding claims 4-6, Ishizuka discloses an amount of carbon dioxide dissolved in a nonaqueous electrolyte to sufficient to provide charge-discharge cycle characteristics [0012] teaching it as a result effective variable. It would have been obvious to one of ordinary skill in the art at the time of the invention to vary the carbon dioxide content since it has been held that discovering the optimum ranges for a result effective variable such as carbon dioxide content involves only routine skill in the art in the absence of showing of criticality in the claimed range (MPEP 2144.05).

Regarding claim 7, Ishizuka discloses a battery construction where the electrolyte and the electrodes are enclosed within cells and a can [0007, 0041-0043] (Figures 1 and 2).

Regarding claim 8, Ishizuka discloses an electrolyte which contains a cyclic carbonate [0013].

Regarding claims 9-13, Ishizuka discloses multiple carbonates including cyclic and chain carbonates which are mixed including ethylene carbonate, propylene carbonate, dimethyl carbonate, and diethyl carbonate [0013].

Regarding claims 14 and 15, Ishizuka discloses a nonaqueous electrolyte that further contains a fluorine containing compound which is a lithium salt [0014].

Regarding claim 16 and 17, Ishizuka discloses a fluorine containing lithium salt of the type $LiXF_y$ including $LiPF_6$ [0014].

Regarding claim 18, Ishizuka discloses an active material particle with a preferable mean particle diameters of 2-20μm [0031].

Regarding claims 20, Ishizuka discloses a current collector which comprises a metal foil having an electrolytic copper or copper alloy surface layer [0039].

Regarding claim 24, Ishizuka discloses active material particles composed of silicon [0017].

Regarding claim 25, Ishizuka discloses an electric conductor which is mixed in the mixture layer [0026].

Regarding claim 26, Ishizuka is directed towards a method for fabricating a rechargeable lithium battery [Abstract] comprised of providing a layer of a negative electrode material including silicon [0017], a binder on the surface of a conductive metal foil current collector [0035, 0039], a positive electrode, and a nonaqueous electrolyte with carbon dioxide dissolved and added in the electrolyte [0010-0012]. The active material particles of Ishizuka would inherently undergo a porosity increase that advances from particles surfaces during charge and discharge since the active

materials are the same as the Applicant's disclosed materials of an active material containing silicon and silicon alloys used in a rechargeable lithium battery [Paragraph 0003 of Applicant's disclosure]. Furthermore Ishizuka discloses the use of electrolyte solvents such as carbonates [0013] and the active material comprised of materials that alloy with lithium but does not explicitly teach the electrolyte forming a film having a lithium-ion conducting capability on a surface of a negative electrode. While the prior art does not explicitly teach forming a film having a lithium-ion conducting capability, these properties are considered inherent in the prior art barring any differences shown by objective evidence between (the object) the electrolyte containing carbon dioxide disclosed in the prior art and the applicant. As (the object) electrolyte taught by the prior art and the applicant are identical within the scope of claims 1 and 3, Ishizuka inherently teaches that the electrolyte containing carbon dioxide forms a film having a lithium-ion conducting capability on the surface of the negative electrode. The evidence of Ishizuka disclosing both the same active materials with the same electrolyte with dissolved carbon dioxide providing increased charge-discharge cycles without spoiling the high capacity of the battery characteristics [Abstract, 0009-0012] makes clear the missing ion conducting film is present and would be recognized by one of ordinary skill in the art. In re Robertson, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999) (MPEP 2112).

Regarding claim 27, Applicant is directed towards the discussion for claim 2.

Regarding claim 28, Ishizuka discloses a step of dissolving carbon dioxide in the nonaqueous electrolyte including pressurizing with gaseous carbon dioxide into the nonaqueous electrolyte [0010].

Regarding claim 29, Ishizuka discloses a method of forming the electrochemical cell under a carbon dioxide content environment [0012].

5. Claims 19 and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishizuka et al. as applied to claim 1 above, and further in view of Fukui et al. (US WO/2002/21616, using US 2004/0043294 for translation and citations).

The teachings of Ishizuka as discussed above are herein incorporated.

Regarding claim 19, Ishizuka is silent towards the mean surface roughness of the current collector.

Fukui teaches a current collector which has an arithmetic mean surface roughness Ra, of at least 0.2μm [0018] for the benefit of increasing the contact area between the active material and the surface of the metal foil and accordingly allows more effective sintering. It would have been obvious to one of ordinary skill in the art at the time of the invention to have a mean surface roughness of at least 0.2 microns on the current collector because Fukui teaches it provides for increasing the contact area between the active material and the surface of the metal foil and allows more effective sintering.

Regarding claim 21, Ishizuka is silent towards an electrolytic copper foil.

Fukui teaches a current collector which comprises an electrolytic copper foil, an electrolytic copper alloy foil, or a metal foil having an electrolytic copper or copper alloy surface layer [0022] for the benefit of having a material with high tendency to diffuse into the active material particles to improve adhesion. It would have been obvious to one of ordinary skill in the art at the time of the invention to use an electrolytic copper foil for the current collector because Fukui recognizes it provides for a surface layer with high tendency to diffuse into the active material particles to improve adhesion.

Regarding claim 22 and 23, Ishizuka is silent towards a binder which remains after heat treatment and comprised of polyimide.

Fukui teaches a binder which remains even after a heat treatment for sintering and comprised of polyimide [0035] because it provides adhesion to the active material particles and remains fully undecomposed after heat treatment for sintering. It would have been obvious to one of ordinary skill in the art at the time of the invention to use a polyimide binder in the battery of Ishizuka because Fukui teaches it provides adhesion to the active material particles and remains fully undecomposed after heat treatment.

Response to Arguments

6. Applicant's arguments filed September 30, 2010 have been fully considered but they are not persuasive.

Applicant's principal arguments are:

(a) the Hiroshi reference (Ishizuka) teaches carbon dioxide in the cell which is conventionally known to be used to prevent the formation of a coating on the cathode

which would teach against the formation of a film having lithium-ion conducting capability on the surface of the negative electrode.

In response to Applicant's arguments, please consider the following comments:

(a) As discussed in the prior office action, Ishizuka recognizes that prior art references teach against the formation of a lithium hydroxide coating on cathode. But is silent against the affects on the formation of a film on the negative electrode which is what the claims are directed towards. Ishizuka further discusses the charge and discharge nature was improved but the specific mechanism by which this occurred was not readily understood which does not teach away form the formation of a film on the negative electrode.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kwang Han whose telephone number is (571) 270-5264. The examiner can normally be reached on Monday through Friday 8:00am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dah-Wei Yuan can be reached on (571) 272-1295. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/K. H./
Examiner, Art Unit 1727

/Dah-Wei D. Yuan/
Supervisory Patent Examiner, Art Unit 1727